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Outcome Analysis of Canalicular Laceration Repair with Self-Retaining Monocanalicular Silicone Stent

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Abstract:
Aim: *To evaluate the clinical efficacy of canalicular laceration repair with self-retaining Monocanalicular Silicone Stent(Mini-Monoka).*
Materials & Methods: *Patients who presented in SMS Hospital Jaipur and had canalicular laceration repair done with self-retaining monocanalicular stent between December 2016 to December 2018 were included in this study. Demographic data, cause of trauma and time duration between trauma and surgery were recorded. Postoperative anatomical and functional success were assessed with complications if any.*
Results: *36 patients included in this study, 26 males and 10 females. Mean age of presentation was 28.31 +/- 16.37 years (range 1 to 62 years). Lower canaliculus was involved in 34(94.44%) and upper canaliculus in 2(5.55%) cases. No case of bicanalicular involvement was seen. The most common cause of canalicular laceration is road traffic accidents (44.44%) followed by wooden stick (19.44%). Surgical lag time was 2.83 days after sustaining of trauma. Anatomical success was noted in 35(97.22%) and functional success was noted in 34(94.44%) cases. 2 patients had early spontaneous removal of stent.*
Conclusion: *The Mini-Monoka monocanalicular stent is a simple, minimally invasive and effective tool for reconstruction of traumatic monocanalicular lacerations. Canalicular laceration repair with self-retaining Mini-Monoka stents showed high anatomical and functional success rate in our study.*

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I. Introduction

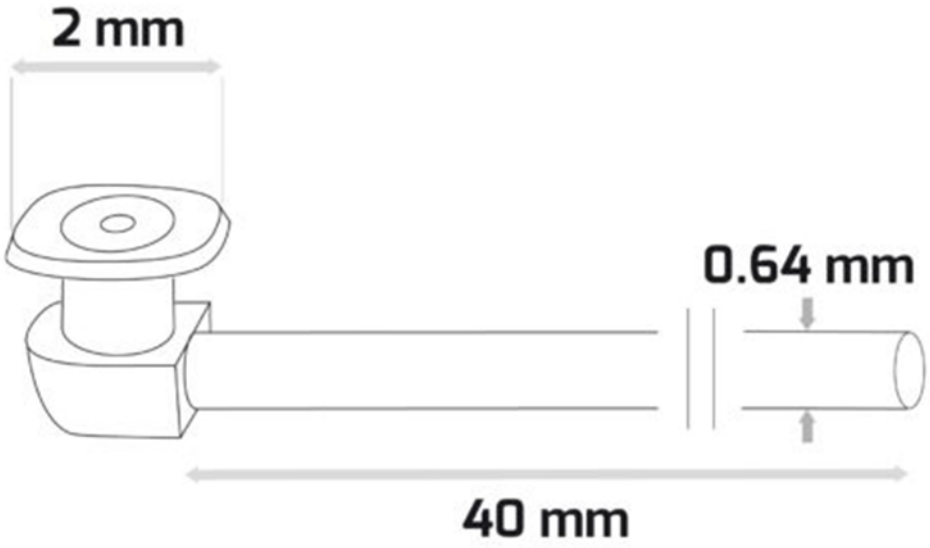
Canalicular lacerations are common entity in ophthalmic practice which are encountered in about 16-26% of all lid tears. They can result from direct or indirect injury, blunt or sharp injury to the canalicular system especially when the medial canthal region is affected. All age groups of patients may be affected; children and teenagers are especially at high risk.

Traumatic canalicular lacerations require stenting of the injured canaliculus to prevent canalicular obstruction. If surgical repair of the lacerated canaliculus is not appropriate, the patient will develop symptomatic epiphora. Lower canaliculi is involved more commonly than upper canaliculi and it plays major part in tear drainage so repairing of lower canaliculi is important to prevent symptomatic epiphora.

The principles of repairing a canalicular injury involves identification of the torn medial end of the canaliculus, suturing of the cut ends under high magnification and intubation of the canaliculus to prevent fibrosis and subsequent stenosis and thereby maintaining its patency.

Silicone because of its inert nature, flexibility, and low degree of reactivity to surrounding tissues has emerged as the material of choice for lacrimal stenting.

The Mini-Monoka (FCI, Cedex, France) monocanalicular stent was first developed and described by Dr Fayet from France.[1]



The Mini Monoka stent (Figure 1) is a silicone tube with a diameter of 0.64 mm and a punctal plug-like head. The construction of the stent head consists of a bulb attached to the silicone tube. A hollow body attaches the bulb to an oval collarette, which in turn holds the stent in place makes it self-retaining.
The present study was an analysis of the demographic characteristics of patients treated for traumatic canalicular damage, features of the injuries causing the damage, and results of surgical treatment.

II. Material & Metheds

Patients who presented at the SMS Hospital Eye Department between December 2016 and December 2018 with canalicular injury and who underwent canalicular laceration repair with monocanalicular silicone stent (Mini-Monoka) implantation by a single surgeon were included in the study.
Study Design: Prospective Interventional study
Inclusion criteria: patient having canalicular laceration in either upper or lower canaliculi or both
Exclusion criteria: Patient having fracture of nasal bone involving nasolacimal duct or lacrmial sac
The following data were recorded: demographic details of the patients, cause of injury, eye findings associated with the damaged canaliculus, time duration between injury and operation and time of removal of stent.
Surgical intervention was performed using operating room microscope. When proximal and distal ends of canalicular laceration were identified, monocanalicular silicone stent implantation was performed with mini-Monoka stent. In all patients, canalicular edges were approximated using 7–0 vicryl sutures. Re-approximation of overlying orbicularis oculi muscle and tissue (medial canthal tendon, lid margin and skin) was done layer by layer.
During the postoperative period, Chloramphenicol + polymyxin B eye ointment 4 times a day for 3 weeks, Caboxymethyl cellulose 0.5% eye drops 2 hourly till stent removal. Postoperative follow-up was done at 1 week, 1 month, 3 months and 6 months after the operation. Tube was scheduled to be removed at 6 months post-procedure. Anatomical and functional success was assessed at follow-up after tube removal. Anatomical success was defined by patency in syringing and probing examination. Functional success was defined by absence of epiphora.

III. Results

Majority of patients are in young age group from 20-40 years (52.78%) with mean age of presentation of 28.31 years.
In our study 26 (72.22%) of the cases were male and female making 10 (27.78%) of the total cases. The most common cause of canalicular laceration is road traffic accidents (44.44%) followed by wooden stick (19.44%).
We found Right eye (63.88%) more commonly affected than the left one. Lower canaliculus was involved in 94.44% cases, upper canaliculi got traumatised in only 2 cases out of total 36 cases.
In our study the average time between the time of trauma to surgical repair was 2.83 days ranging from 1 day to a maximum of 12 days.

Additional injuries are seen in majority of cases in our study. Subconjunctival haemorrhage was the most commonly associated ocular injury with canalicular laceration in the eye followed by lid abrasions.
35 cases out of 36 cases show patency (97.22%) om syringing after removal of Mini-Monoka stent at 6 months which is our anatomical success.
Functional success was achieved in 94.44% cases with absence of epiphora(watering) after removal of stent. Only 2 patients had intermittent watering in eye regarded as failure.
Complication of spontaneous removal of stent was only seen in 2 cases in this study, when 7-year-old child rubbed his eyelid and the other with a 62 years old male patient.

Table 1. Demographic profile of patients undergoing Canalicular laceration repair.

Total patients	36
Males	26 (72.22%)
Females	10 (27.78%)
Eye involved	
Right	23 (63.88%)
Left	13 (36.11%)
Canaliculus involved	
Upper	2 (5.55%)
Lower	34 (94.44%)
Mean time between injury and repair	2.83±1.93 days (Range: 1 to 12 days)

Table 2: Age wise Distribution of Patients:

	Number of Cases	Percentage
0-10	8	22.22
11-20	2	5.56
21-30	9	25.00
31-40	10	27.78
41-50	3	8.33
51-60	3	8.33
61-70	1	2.78
Total	36	100.00
Mean±SD	28.31±16.37 years	

Table 3: Mode of Injury

Mode of Injury	Number of Cases	Percentage
Blouse hook	2	5.56
Dog bite	2	5.56
Fall from cycle	1	2.78
Fist	2	5.56
Iron wire	3	8.33
RTA	16	44.44
Stone	3	8.33
Wooden stick	7	19.44
Total	36	100.00

Table 4: Associated Ocular Injuries

	Number of Cases	Percentage
Lid abrasion	9	25
Lid abrasion facial injuries	2	5.5
Lid abrasion subconj. Haemorrhage	2	5.5
Subconj. Haemorrhage	20	55.5
No injury	3	8.3
Total	36	

Table 5: Anatomical Success

Syringing	Number of Cases	Percentage
Patent	35	97.22
Non- patent	1	2.78
Total	36	100

Table 6: Functional Success

Epiphora	Number of Cases	Percentage
Absent	34	94.44
Intermittent	2	5.56
Total	36	100.00

IV. Discussion

Canalicular damage may be classified as result of direct or avulsive injury; however, precise boundaries to distinguish groups are very difficult to implement. While sharp, cutting objects produce clean, straight laceration, effects of many types of blunt trauma can lead to avulsion of the canalicular structures. In 25-case review conducted by Wulc et al.(1991)[18], they reported 84% avulsive injury and 16% direct injury. Jordan et al.(2008)[19] reported that direct injury was responsible for laceration in more than half (54%) of cases.

Canalicular laceration is especially seen in children and young adults. Naik et al.(2008)[11] reported in a 24-case series that age range of patients was 10 months to 52 years, with mean age of 16 years. Hwa Lee et al.(2009)[12] found mean patient age as 34 years (range 1–64years) in their study. In study conducted by Argın et al.(2001)[20] mean age was 21 and age ranged between 1.5 and 64 years. Leibovitch et al.(2010)[13] reported mean age of 34 years in their 19 patient study. Mean age was 31 years in study reported by Demir et al.(2011)[21] Similarly, in this study, there was broad age range in patients composed primarily of young adults (mean age: 28.31 years).

Naik et al.(2008)[11] has found blouse hook fastener as the cause of injury in five breast feeding infants, we too had two cases of blouse hook injury. Selam Yekta Sendul et al.(2014)[14] in their study reported the most common etiology of canalicular laceration was assault(n=16,38.1%) followed by traffic accidents(n=8,19.05%). Swati Singh et al.(2015)[15] reported cause of injury as blunt trauma in 51.2%, road traffic accidents in 30.7% and animal injuries in 15.3% cases. In our study road traffic accidents (44.44%) were the major cause of injury followed by wooden stick injury (19.44%).

Gender distribution in this study is similar to that seen in the literature, and there is an obvious male predominance. In study conducted by Kennedy et al.(1990)[8] 166 (75%) of 222 patients were male. Naik et al.(2008)[11] observed 20 (83.3%) patients were males. Leibovitch et al.(2010)[13] reported 15 of the 19 patients were male. Argın et al.(2001)[20] reported all 10 cases were male, and 15 (75%) of 20 cases were male in the study of Demir et al.(2011)[18]. Swati singh et al.(2015)[15] in their study they found majority were male (79.5%). Md. Shahid Alam et al(2017)[17] A total of 29 patients underwent canalicular tear repair with self-retaining Mini-Monoka stent. Out of 29 patient, 23 (79.3%) were males. As for the present study, 72.22% of the 36 patients were male and 27.78% were female.

Kennedy et al.(1990)[8] reported 66% inferior canaliculus, 28% superior canaliculus, and 6% both canaliculi affected. Hwa Lee et al.(2009)[12] found inferior laceration in 72%, superior laceration in 28% of cases. Leibovitch et al.(2010)[13] reported 15 cases to be involving lower canaliculi out of total 19 cases and the rest involving upper canaliculi. Md. Shahid Alam et al.(2017)[17] reported lower canaliculus was involved in 19(65.5%), upper in 8 (27.5%) and both canaliculi in 2(6.8%). In the present study, percentage of inferior canalicular injury cases was 94.44% (n=34), whereas superior canaliculus was site of trauma in 5.55% (n=2). There were no cases of injury to both canaliculi.

Canalicular injury can be accompanied by other injuries to the eye. It has been reported that the most frequently seen accompanying injuries are eyelid laceration, hyphaema, corneal abrasion, subconjunctival haemorrhage and globe perforation. In this study, majority of patients had additional eye injuries. Most common was subconjunctival haemorrhage seen in more than half of patients followed by abrasions of other parts of the eyelid. In cases of dog bite additional facial injuries were also seen.

Ideal time for repair of canalicular laceration after sustaining trauma is questionable. Edema and wound healing response at ends of the canalicular and pericanalicular tissue can make it difficult to determine localization of distal edge of laceration.[8] For this reason, it is recommended that repair should be performed within first 24 to 48 hours after trauma. However, authors such as Hawes et al(1995)[22] have reported successful surgical correction can be performed within first 5 days. Kennedy et al(1990)[8] did not establish any correlation between period post trauma and surgery and postoperative epiphora. In the present study, surgery was performed at average of 2.83 days, with 12 days was the longest time duration between trauma and its repair. High success rate achieved in this study suggests that treatment provided by experienced team in appropriate conditions is more important than length of time between trauma and repair.

The first step in canalicular repair is to find medial edge of the lacerated canaliculus. It can be done under the microscope.

There is no consensus on period of time silicone tube is to remain in place in case of canalicular trauma; recommended period varies from 3 months to 1 year. Conlon et al.(1990)[9] in an animal model, determined higher canalicular patency when removed at 12 weeks compared to 4 or 8 weeks, and reported that 12 weeks was optimal duration before extraction. Selam Yekta Sendul et al(2014)[14] had placed stent for 6

months. In this study, stent removal was done at 6 months for better healing process and epithelisation of the lumen of the lacrimal canaliculi.

Most important complication related to monocanalicular intubation is early tube dislocation. In 19-patient series of Leibovitch et al.(2010)[13], early tube dislocation was not observed in any patient. Salem Yekta Sendul et al(2015)[14] reported 2 early stent extrusion and one punctal slit as complication. Hwa Lee et al.(2009)[12] reported postoperative complications which includes early tube protrusion (n=2, 6%), punctual slits (n=2, 6%) and punctal granuloma formation (n=1, 3%). Risk of early tube dislocation can increase, especially in children, due to rubbing and scratching. This complication was only seen in 2 cases in this study, when 7-year-old child rubbed his eyelid and the other with a 62 years old male patient.

It is widely thought that inferior canalicular laceration repair is more important and requires mandatory treatment because of the belief that it has more significant role in drainage. Therefore, repair of superior canalicular laceration may be ignored. Contrary to that general belief, however, Daubert et al.(1990)[23] found that inferior and superior canaliculi were equally involved in tear drainage in a scintigraphic study. Moore and Linberg et al.(1988)[24], in an experimental study in which they obstructed single canalicular, determined that subjective findings occur in 56% of upper canalicular obstruction events, and in 63% of lower canalicular obstructions, and concluded that both canaliculi have equal role. The present study had only 2 cases of upper canalicular lacerations.

Naik et al(2009)[11] reported anatomical(90%) and fucnctional(100%) success in 24 canalicular laceration repair with Mini-Monoka stent. Salem Yekta Sendul et al.(2015)[14] has got anatomic success (96.87%) and functional success (92.85%) in their study of 32 canalicular laceration repair with Mini-Monoka stent. Study done by Md. Shahid Alam et al.(2017)[17] had achieved anatomical success in 12 (85.71%) and functional success in 13 (92.85%) cases.

In our study anatomical success is achieved in 97.22% cases with only 1 failure out of 36 cases who come for follow up. 35 patients have shown patency on syringing of the repaired canaliculi after removal of the stent. The only case who resulted in non-patency on syringing is the one who had early spontaneous removal of stent.

Functional success is achieved in 94.44% cases with absence of epiphora at 6 months. Two patients had intermittent epiphora regarded to be failure.

V. Conclusion

In conclusion, Mini monoka stent is an effective, easy to use tool in reconstructing traumatic canalicular laceration. Canalicular laceration repair with self-retaining Mini-Monoka stents showed high anatomical and functional success rate in our study. Mini-monoka stent does not threaten the uninjured or unaffected part of the lacrimal drainage system and thus there is no possibility of damage to the other canaliculus. Canalicular laceration is most commonly seen young male patients following Road traffic Accidents.

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Post RTA canaliculi laceration

Mini-Monoka stent passed through cut ends

Mini-Monoka stent in situ after implantation

Canalicular laceration due to cycle handle injury

Punctum dilatation done by punctum dilator

Mini-Monoka stent in situ after implantation